

IV. Maintenance and Management Procedures

Slope Stability and Erosion Control

Some of the viewpoint park sites are located on steep slopes potentially subject to instability, surface erosion and land mass movement. Control of geologic and soil structure must be managed by a geotechnical specialist and cannot be achieved through vegetation management. The intent of the vegetation management plans is to manage and propose vegetation that supports soil strength and slope stability. Covering exposed soils and preventing surface erosion is the first step in protecting the stability of slopes. Erosion control is the most important reason for planting and maintaining a vegetative cover on slopes.

Planting Layered Vegetation to Increase Slope Stability

Current studies indicate the importance of approaching vegetation management on slopes within natural, open space lands from a long-term and holistic perspective. Slope stability studies recommend the value of maintaining multi-layered vegetation for the greatest success in stabilizing slopes. Tree roots help to stabilize soil while pumping excess water from saturated soil in wet conditions. Mid-story shrub layers and ground covers produce fibrous root mats that help to keep topsoil on the slope while also helping to break the impact from rain, minimizing raindrop erosion on exposed soils.

Erosion Blankets

To retain soil on slopes 30% or greater, an erosion control mat is to be applied prior to planting. Erosion control mats are manufactured for a range of conditions and purposes. Typically, mats adhere to the soil with 20" 'hairpin' staples, spaced 20-25 feet apart in a grid pattern depending on the steepness of the slope. Product selection is based on need and product longevity. Shorter-term needs for moderate slopes with low water flow require different products than steeper sites with high water movement. Conditions should be evaluated for each site to determine the appropriate type of erosion blanket for the condition: Some commonly used examples in order of extended use:

- jute blankets
- compost or woodchip blanket
- straw mats enclosed in polypropylene netting
- coconut blankets enclosed polypropylene netting
- straw/coconut layered blankets
- u.v.-resistant polypropylene fiber netting

Select material depending on recommendation of Parks geotechnical engineer and available budget. In general, avoid using netted material

wherever possible, in interest of wildlife protection. A product information resource for types of erosion control blankets is North American Green Inc.:

www.nagreen.com/product

Pruning and Removal Standards

Pruning Specifications

Pruning the viewpoint park site is the preferred maintenance technique when meeting one or more of the following objectives;

- remove the density of the crowns to optimize views and improve tree structure
- reduce wind resistance
- increase the health and condition of the trees
- provide 'view corridors' and 'windowing' to improve views
- lifting lower limbs to optimize views
- reduce hazard potential

Pruning shall conform to ANSI 300 standards. These standards meet the values and principles of the National Arbor Association (NAA) and the International Society of Arboriculture (ISA). Copies of the standards are found in the Appendix. Pruning will be limited to the removal of: dead, diseased, or dying limbs, co-dominant leaders causing inherent structural problems, crown thinning. Crown reduction or pollarding techniques may be practiced if determined necessary by a DPR Urban Forester. As specified in the standards under Pruning Practices, section 5.6.2.2, no more than 25% of the crown can be removed within an annual growing season for any of the trees identified on the tree pruning plan. If a greater percentage of canopy removal is preferred, removal and replacement should be considered.

Removal Specifications

Tree removal is the preferred maintenance technique when meeting one or more of the following objectives:

- potentially hazardous trees that cannot be abated by pruning
- dead, decayed or diseased trees
- trees in poor health, condition and structure due to previous 'topping' practices
- to optimize view shed and replace tree with more appropriate species
- increase light to the forest floor for the establishment of more suitable trees and shrubs.

Final determination for any tree removal will be determined by a DPR Urban Forester in accordance with the department's *Tree Management, Maintenance, Pruning and/or Removal Policy and Procedures*, adopted June 1, 2001.

Hazardous Trees

For a tree to be considered hazardous there must be a target. Targets can range from neighboring trees in wooded areas with no public access (low hazard), to houses, buildings or public use areas (high hazard potential). In addition, there needs to be one or more reasons to believe the tree could fail based on its health, condition, and structural integrity. Potentially hazardous trees are to be evaluated by a skilled arborist to determine the appropriate action in abating the situation.

Woody debris from Pruning and Removal Work

All woody debris 8 inches or less in diameter should be managed by one of the following practices:

1) where site restoration requires a 'Spyder' excavator or mulching machine to dispose of invasive understory growth, a 'dice and scatter' technique can be used to disperse the mulch. A maximum 3 inch layer of diced brush can be spread throughout the site. Excess of this amount should be removed and stored for later use. If restoration planting is planned, it will occur within pockets of the brush mulch. (Spyder excavation can be contracted with KempWest Inc. 425-334-8253 in Everett, Washington)

2) where a predominance of tree pruning and removal occurs on a site, woody debris and brush should be hauled and chipped for reuse. Wood chips will be stored at designated locations for mulch reapplication if restoration planting is planned.

NOTE: To prevent a public nuisance and fire fuel from accumulating, dried brush piles of leaves, downed limbs and branch debris should be addressed immediately following pruning and removal work.

Ecosystem Restoration

The following procedures should be utilized where possible to enhance ecosystem restoration and wildlife habitat:

- wood greater than 8 inches in diameter can be cut in lengths no greater than 20 feet and left in contact with the soil for degradation, forest restoration and ecosystem management value. Leave large branches and trunks running parallel with the slope except in steep

slope areas. Number 3 rebar should be available for staking logs to in position and to prevent downward movement where needed.

- remove specified trees to snag height (20-30 feet) to increase wildlife habitat (identification, quantity and height will be determined by the projects' urban forester)
- retain stumps resulting from removals to add natural compost and to maintain slope stability until new vegetation is established
- Lombardy poplar logs should be elevated off ground or removed from site to prevent resprouting

In the event the amount of woody debris exceeds the threshold for reuse (as determined by the projects' Urban Forester), wood may be cut into 18 inch lengths and left on accessible edge of site for firewood under the direction of a DPR Urban Forester.

Soil Compaction

To minimize soil compaction on viewpoint sites, care should be given during pruning, removal and clearing activities to prevent an imbalance of drainage, surface run-off and over saturated soil conditions. The following guidelines will help to prevent compaction and protect slopes during restoration work:

- identify locations for ingress and egress for rehabilitation activities
- limit heavy equipment use to designated areas
- prohibit site work during wet conditions when soils are near saturation
- locate and indicate in the field 'haul and drag' routes for removing downed debris

Invasive Weed Removal

Control methods for exotic weed species shall emphasize the least toxic approaches available, emphasizing hand-pulling, mowing, girdling and grinding (Spyder machinery). Use of chemical controls will be limited and subject to approval by DPR staff. Herbicides shall be applied by a licensed pesticide applicator only, according to label instructions. Final recommendations for weed removal and control will be determined by the DPR Senior Gardener and Urban Forestry staff. The following list identifies weeds most frequently found within the viewpoint parks. Those indicated with a * will require the greatest amount of labor and cost to control because of their extensive invasion.

Targeted exotic weeds

* <i>Rubus discolor</i>	Himalayan blackberry
* <i>Hedera helix</i>	English Ivy
<i>Ilex aquifolium</i>	English holly
<i>Prunus laurocerasus</i>	English laurel
* <i>Clematis vitalba</i>	Wild clematis
<i>Cytisus scoparius</i>	Scotch broom
<i>Equisetum hyemale</i>	Horsetail

Eradication of English Ivy

English ivy (*Hedera helix*) is an evergreen, invasive vine growing at many park viewpoints, especially where shady. Hand-pulling is the most effective removal method for this plant, if ground disturbance is not a major issue due to steepness of slope. Removal must be coupled with follow-up mulching and replanting on hillsides.

Research data indicate that ivy left growing on trees will become woody and girdle the tree, restricting translocation of water and nutrients. Therefore, initial control efforts should target vines climbing any trees to be retained. Vines should be cut at shoulder-height, and again at the base all the way around the circumference of the tree. In the interest of safety, do not pull cut vines down from trees. A radius of at least 5 ft. from the base of the tree should also be cleared of ivy – called a ‘tree lifesaver’ or ‘survival ring.’

Where appropriate, patches of ivy can be removed by hand-pulling and vines rolled into a mat or ball. Removal of ground layer ivy where there is still a fairly intact native shrub layer can be done without replacement planting. Removal of dense mats in the ground layer lacking native shrubs and herbs should only be done if subsequent replanting is an option. High-density planting and intensive maintenance should be provided so that 100% foliar coverage is achieved within three years. During the first three growing seasons after initial clearing, ivy regrowth must be carefully weeded from desirable vegetation.

More extensive instructions for manual ivy removal can be found at www.ivyout.org/ivyremove.html. If adaptive management and IPM protocols warrant, ivy may also be controlled by glyphosate herbicide with added surfactant selectively applied to new leaf growth in June by wiper applicator. This process requires careful material handling and patience and should only be done under direct supervision by licensed pesticide applicators. However, it may be the preferred strategy on steep slopes where ground disturbance is undesirable.

Eradication of Wild Clematis

Clematis vitalba, also called Traveler's Joy, is a woody vine that primarily climbs trees. Control involves cutting the vine at the base near the ground in early summer before seed production occurs, and either grubbing out the root, or applying herbicide (Roundup with water soluble dye) directly onto the surface of the cut stump. Choice of method will be determined by IPM protocols. Any herbicide application requires careful material handling and patience and should only be done under direct supervision of licensed pesticide applicators. Dead top growth can be removed in fall or winter when vines have become brittle or left to disintegrate on its own. Cut vines should be flagged for follow-up monitoring, since several treatments may be necessary. Once mature, this plant has tenacious, extensive roots that are not easily pulled without significant effort and ground disturbance. Exercise caution and professional judgment when considering mechanical removal on steep slopes.

Eradication of Himalayan Blackberry

Current research indicates the best method of eradicating Himalayan blackberries requires an integrated management approach combining both physical removal of the plant along with foliar application of the systemic herbicide Roundup for regrowth.

Roundup is a systemic herbicide and an EPA confirmed product, for a safe, but aggressive approach to eradicating invasive blackberries in upland areas. Procedures for eradication of invasive Blackberry in upland areas:

- 1) Initial physical removal of canes to the ground can be accomplished either by hand or a variety of mechanical means, the latter more realistic for large areas. The Spyder may be suitable for cutting blackberry on slopes too steep or inaccessible for other equipment.
- 2) An early spring foliar application when leaves are most receptive can prevent vigorous regrowth and begin eradicating existing vegetation.
- 3) A follow-up application in late summer or early fall will increase systemic transport to the roots and minimize regrowth the following growing season.

These procedures may require two seasons before eradication is complete. Planting could occur after the first year's application with regular spot treatments in resurgence areas for the subsequent year.

Where feasible, crown grubbing can greatly reduce resprout growth. This practice is recommended only where extent of blackberries and slope stability concerns are not excessive. Deep organic mulch application (6" minimum) also impedes regrowth, especially from seed stored in the soil.

For more information contact: Frankie Porter, Weed Management Consultant
Wilbur-Ellis Company
1521 15th Street NW Suite 5
Auburn, WA 98001
1-800-275-6920 or 253-209-1388

Kari, Hakso, Kemp – West (Spyder)
(425) 334-5572
Snohomish, WA

Eradication of Other Invasive Species

Other invasive species are more easily controlled by physical removal. Many species listed above are frequently 'bird planted' and generate readily from seeds. It is recommended to remove these species as they will compete for light and water with new plantings. Removing English Holly, English Laurel and English Ivy should occur annually and be a part of on-going maintenance practices.

Restoration Planting

Site Preparation

In preparing the site for planting, the following procedures are to be completed first:

1. all tree pruning and removal work
2. all woody debris removed from site
3. invasive weed species have been eliminated
4. mulch is available for application after planting
5. planting soil is free of ground brush or wood chips at root level (woody mulch mixed with soil can inhibit nitrogen availability to plants; corrective fertilization is an option where this does occur)
6. water or irrigation for plant establishment after planting is available

Tree Replacement Requirements

Tree replacement will meet the criteria stated in the Department of Parks and Recreation's *Tree Management, Maintenance, Pruning and/or Removal* policy adopted in June, 2001:

Section 6.5.2 Performance Criteria: Replacement of Trees

At minimum, each tree that is removed will be replaced by planting another tree close to the original location. Tree species selection and numbers will be required to meet or exceed the loss of mature canopy proposed by the project.

The species of replacement trees may vary from the species removed if they can meet the following replacement criteria:

- provide equal or greater canopy coverage
- are genetically appropriate for height in prohibiting obstruction of views
- require little or no maintenance, and are adapted to winter/wet and summer/dry climate
- provide enough light to prohibit excessive shading of understory plants

Because viewpoints by their nature require reduced canopy height, it may be more ecologically-appropriate to replant some lost canopy volume in nearby, off-site locations. Parks Urban Forester will confirm maximum tree density compatible for achieving a multi-tiered plant community on the slope. Excess replacement trees are to be planted at reforestation sites identified by the Urban Forester in conjunction with resource staff, and provided three-year establishment care to insure survival.

Shrub and Groundcover Replacement Requirements

The following formula is recommended by King County Department of Development and Environmental Services (DDES), specified in the *Restoration and Enhancement Guidelines* publication. The formulas have been field tested and provide the necessary understory cover to meet performance standards and compete with the invasive weed re-establishment.

Total SF of Area X 0.028 per square foot for shrubs = # of shrubs planted 6' on center.

Total SF X 0.063 per square foot for groundcovers = # groundcovers planted 4' on center.

All plants must meet the American Standard for Nursery Stock as outlined in ANSI Z60.1-1996.

Plant Selection

A primary factor in selecting plant species was to choose trees and shrubs whose genetically mature height minimizes the need for pruning or topping to retain viewsheds.

Plant selection considers predominately native plants or other species that will naturalize and adapt to the site's light, soil and water conditions without becoming invasive.

Other criteria considered in selecting plants:

- genetically appropriate for viewpoint restoration
- readily available in the nursery trade
- reduced maintenance demands
- assist in maintaining slope stability
- attract wildlife and support their habitat needs
- provide species diversity to re-establish a healthy, native ecosystem
- meet public safety criteria of CPTED (Crime Prevention through Environmental Design)
- low implementation costs

Plant Recommendations

Zone 1 – Developed park landscape

Replanting in this zone should be done under the direction of the specific park's senior staff and gardeners. Plant recommendations and management practices should integrate with the maintenance of the existing vegetation.

Zone 2 – Transition area at crest of slope

Selected plants provide a hedge-effect when planted in close proximity. Species have been chosen for height, spread and density to create a barrier between Zone 1 and Zone 3. Where appropriate several layers of shrub may be needed to protect the crest of the slope from eroding. Plants listed vary in height and are selected for appropriate placement on the slope to optimize views. Plants at the top of slope should not exceed 3' in height. Taller plants can be used to stabilize conditions where the grade drops sufficiently. Lateral distance from crest of slope will vary with steepness of gradient.

Species can be intermixed for seasonal interest, aesthetics and wildlife value. Where barrier plantings abut predominantly natural vegetation, native species are preferred for hedging. In ornamental environments, select species for optimal function and appearance from list below.

SHRUBS 2-3' IN HEIGHT
Berberis thunbergii "Crimson Pygmy. – Dwarf Red Barberry
Berberis verruculosa – Warty Barberry
Chaenomeles 'Cameo' or 'Jet Trail' – Low Flowering Quince
Ilex cornuta 'Dwf Burford' – Dwf Japanese Holly
Ilex crenata 'Helleri' - Japanese Holly
Mahonia aquifolium 'Compacta' – Compact Oregon Grape
Mahonia repens - Creeping Mahonia
Rosa 'The Fairy' – The Fairy (Pink Polyantha) Rose
Rosmarinus officinalis - Rosemary
Symphoricarpos 'Hancock' – Hancock Coralberry
SHRUBS 5-6' IN HEIGHT
Abelia grandiflora ' - Glossy Abelia
Arbutus unedo 'Compactus' – Dwf Strawberry Tree
Berberis darwinii – Darwin Barberry
Chaenomeles 'Hollandica' or 'Apple Blossom' – Tall Flowering Quince
Choisya ternate – Mexican Orange
Cornus stolonifera 'Isanti' – Compact Redtwig Dogwood
Mahonia aquifolium – Oregon Grape
Osmanthus delavayi – Delavay Osmanthus
Pinus mugo mugo – Compact Mugho Pine
Rosa rugosa – Rambling Rose
Symphoricarpos albus - Snowberry
Vaccinium ovatum - Evergreen Huckleberry

Zone 3 – Hillside

Selected plants for Zone 3 provide multi-layered vegetation for the greatest success in stabilizing slopes and creating a more natural environment. Plantings are to be intermixed, using both evergreen and deciduous trees, tall shrubs, small shrubs and groundcovers.

TREES
Acer glabrum douglasiana – Douglas Maple
Acer circinatum - Vine Maple
Juniperus scopulorum – Rocky Mountain Juniper
Myrica californica – Pacific Wax Myrtle
Rhamnus purshiana - Cascara
Corylus cornuta - Western Hazel
Pinus contorta - Shore Pine
SHRUBS
Amelanchier alnifolia - Serviceberry
Holodiscus discolor - Oceanspray
Mahonia aquifolium – Oregon Grape
Oemleria cerasiformis – Indian Plum
Philadelphus lewisii – Native Mock Orange
Physocarpus capitatus – Pacific Ninebark
Rhododendron macrophyllum – Pacific Rhododendron
Rosa nutkana – Nootka Rose
Rosa rugosa – Rambling Rose
Rubus spectabilis – Salmonberry
Sambucus racemosa - Red Elderberry
Stranvaesia davidiana 'Undulata'
Symphoricarpos albus - Snowberry
Vaccinium ovatum - Evergreen Huckleberry
Vaccinium parvifolium -Dec. Huckleberry
GROUNDCOVERS
Arctostaphylos uva-ursi - Kinnikinnick
Cornus sericea 'Kelsey' – Kelsey Dogwood
Fragaria chiloensis – Coastal Strawberry
Juniperus communis – Common Juniper
Lonicera pileata – Privet Honeysuckle
Mahonia nervosa – Low Oregon Grape
Mahonia repens – Creeping Mahonia
Parthenocissus tricuspidata 'Veitchii'
Polystichum munitum - Sword Fern
Rosa wichuriana – Memorial Rose
Rubus calcynoides – Ornamental Bramble
Tellima grandiflora - Fringecup
Vancouveria hexandra – Vancouveria, Inside-out Flower

Fertilizer and Mycorrhizal Applications

Both mycorrhizal fungi and fertilizer are recommended to be applied at time of planting, to boost establishment success in the typically-challenging, high-visibility environments of viewpoints. If labor and initial cost make such applications prohibitive, plant selection, installation and aftercare must be particularly carefully done.

Mycorrhizal fungi form symbiotic relationships with plant roots, increasing their ability to take in nutrients and water from the soil; the plants in turn provide food for the fungus. Mycorrhizae in granular or tablet form can be obtained from:

Mycorrhizal Applications, Inc.

PO Box 1181

Grants Pass, Oregon, 97528 Phone: 541-472-3985

info@mycorrhizae.com Attn: Mike Amaranthus / Jeff Anderson

Planting fertilizer should be applied in a compressed tablet form such as 20-10-10 (20% nitrogen, 10% phosphorus, 10% potassium) like Agriform with micro-nutrients added, or an approved equal. Application rates should comply with the manufacturer's recommendations. Bonemeal should be added to all planting pits prior to tree or shrub placement.

Mulching

All restoration areas are to be mulched with 3-6 inches of wood chips, imported or stockpiled from tree removal and pruning operations. Prevent any direct contact of mulch with the trunks or stems of plants. Wood chips will suppress weeds, aid soil composition and water retention, and reduce surface erosion.

Irrigation

Temporary irrigation will be imperative to maximize survivability of restoration plantings and to encourage new growth competitive with weed resurgence. Recommended rates for a three year plant establishment period are:

- Insure that plants receive at least one inch of water per week from June-October during the first two growing seasons, unless adequate rainfall occurs or site soils are naturally moist year-round. Generally, irrigation must be provided between mid-July and September, and earlier or later depending on the year.
- Third year watering may be reduced to equivalent of ½ inch per week.
- Monitor and adjust water delivery to insure full site coverage.
- Provide water at a rate that it does not run off steep slopes before being absorbed into ground; berms or cribbing on downslope side of plants help hold irrigation water and moisture-conserving mulch.

Performance Standards

Monitor and suppress the invasion of weeds throughout the site. If herbicides are used for weed control, conservative treatment methods should be used i.e. wiper application for stump treatment of sucker regrowth, selective hand-spraying for spot treatments. All effort will be made to reduce the amount of chemical utilized on viewpoint sites.

The following performance standards are recommended:

- 1) Vegetation will have 80% survival after 3 years
- 2) Tree and shrub cover will be greater than 10% after one year, greater than 30% after two years and greater than 50% after three years.
- 3) Non-native invasive plants will not make up more than 10% of cover in any growing season.
- 4) Replace dead plants up to and including the third year after planting.